

## Critical Confluence

### Gene Variants, Insecticide Exposure May Increase Childhood Brain Tumor Risk

Epidemiologic data have suggested a link between pesticide exposures and childhood brain tumors. The link may be specific to insecticides such as organophosphorus and carbamate compounds, which are known to target the nervous system. Previously published work [EHP 113:909–913] investigated the role of individual genetic variation with a focus on paraoxonase (PON1), a key enzyme in the metabolism of organophosphorus insecticides commonly used in homes at the time but now banned for residential use. This work showed that children with brain tumors were more likely to carry a common single-nucleotide polymorphism (SNP) gene variant in the promoter region of the *PON1* gene (*PON1*<sub>C-108T</sub>) than other children, and that the association between this SNP and brain tumors was stronger in children with a history of home insecticide exposure. Research in an expanded study population now provides additional evidence that exposure to insecticides, paired with specific metabolism gene variants, may increase the risk of childhood brain tumors [EHP 118:144–149; Searles Nielsen et al.].

The research population included 201 children in California and Washington who had been diagnosed with a primary tumor of the brain, cranial nerves, or meninges between 1984 and 1991, as well as 285 children from the same geographic areas who served as controls. All children were aged 10 years or younger. Genetic information was extracted from archived dried blood spots used for routine screening

tests when the children were born. In addition to *PON1*<sub>C-108T</sub>, the genetic analysis covered 7 other gene polymorphisms that might influence the children's ability to metabolize insecticides. Interviews with the children's mothers provided data on prenatal and childhood exposures to insecticides in the home.

Between the cases and controls, there was little difference in the prevalence of any of the polymorphisms. For cases, more of the mothers reported in-home insecticide use during pregnancy, but in-home treatment during childhood was more common among controls. Data analysis confirmed the original observation that children exposed to insecticides were more likely to have brain tumors if they also carried the *PON1*<sub>C-108T</sub> SNP. Evidence of similar interactions also were observed with two other gene variants, *FMO1*<sub>C-9536A</sub> and *BCHE*<sub>A539T</sub>, which also may affect the ability to detoxify organophosphorus and/or carbamate insecticides.

These findings suggest that children who are exposed to insecticides at a young age may have a greater risk of developing brain tumors if they carry these and possibly other polymorphisms. Larger studies are needed to confirm the findings, and environmental and biological measurements of specific pesticides, inclusion of more polymorphisms, and detailed information on exposure timing and dose would strengthen support for causal effects of insecticides and gene–environment interactions on the risk of childhood brain tumors.

**Julia R. Barrett**, MS, ELS, a Madison, Wisconsin–based science writer and editor, has written for EHP since 1996. She is a member of the National Association of Science Writers and the Board of Editors in the Life Sciences.

## When to Warn?

### Comparing Heat Indices to Evaluate Public Health Risks

Summer heat waves can be deadly, particularly for vulnerable populations such as the elderly. Prior to a heat wave's arrival many cities warn their residents to take precautions such as making sure they drink enough water. But what are the best criteria for issuing a warning of an impending heat wave? A team of scientists from the New York City Department of Health and New York University Medical School compared different metrics used to predict these potentially lethal events [EHP 118:80–86; Metzger et al.]. They found that New York City's current method of basing advisories on the maximum heat index provided a realistic prediction of mortality risk during hot weather.

New York City is one of several places where alerts of excessive heat are triggered by rises in the maximum heat index, a combination of heat and humidity conditions that are forecast for the succeeding 24–48 hr. Alerts typically are issued when the maximum heat index is forecast to exceed 100–105°F (depending on location); some meteorological judgment can be applied by National Weather Service regional staff in whether to issue a heat alert.

In other cities, alerts are triggered by certain spatial synoptic classification (SSC) categories. Under the SSC system, the dominant local weather pattern is categorized into one of several types depending

on temperature, dew point, wind direction, wind speed, and cloud cover, as measured four times daily. The SSC categories classified as potentially dangerous weather patterns are determined for a local area by calculating the historical number of deaths in the local region associated with those weather patterns.

The researchers evaluated models using the maximum heat index, the SSC, and maximum, minimum, and average temperatures to predict heat wave deaths in New York City between 1997 and 2006.

They found the National Weather Service maximum heat index provided the most reliable prediction of heat-related deaths as confirmed by mortality data from the city's Office of Vital Statistics, with a spike in the magnitude of the heat–mortality association at maximum heat indices of 95–100°F. Using more variables such as wind speed and precipitation in forecasting heat waves improved the predictive models slightly but also complicated the task of translating complex forecasts into meaningful public health messages.

The authors conclude New York City officials should continue to issue heat alerts when the maximum heat index is forecast to exceed 95–100°F. They also say that repeated warnings should be issued throughout the heat wave and as the maximum heat index increases. Before other cities adopt use of the maximum heat index, however, they should conduct their own analyses with local data.

**Harvey Black** of Madison, Wisconsin, has written for EHP since 1994. His work has also appeared in *Environmental Science & Technology*, *ChemMatters*, and the *Milwaukee Journal Sentinel*.

New York City heat wave, 2 August 2006

